

**In the Specification:**

Amend various locations as follows:

Page 1, lines 3-11

**RELATED U.S. APPLICATIONS CROSS-REFERENCE**

This ~~is a~~ application has the same title and is a Continuation-In-Part of application ~~serial number~~ **Serial No. 10/778,777 (not yet assigned)** filed February 12, 2004 which is a Continuation-In-Part of application Serial No. 10/753,278, filed January 8, 2004, which is a Continuation-In-Part of application Serial No. 10/058,868, filed January 28, 2002 **(now U.S. Pat. 6,675,931, issued January 13, 2004)**, which is a Continuation-In-Part application Serial No. 09/542,155, filed April 4, 2000 (now U.S. Pat. No. 6,460,651, issued October 8, 2002), which is a Continuation-In-Part application of application Serial No. 09/201,398, filed November 30, 1998 (now U.S. Pat. No. 6,044,925 issued April 4, 2000).

Page 34, lines 10-16:

Figures 36A through 45B illustrate a variety of embodiments of low profile, shallow speaker embodiments of the present invention that are mountable in shallow, small clearance locations. To simplify the understanding of each of these embodiments, elements in the various figures that are the same have been given the same reference number. Those elements that are modified and which perform the same or similar function have the same number with the first use without a prime and **for** each variation one or more primes have been added to the reference number.

Page 35, line 5 through page 36, line 6:

Additionally, there is a stiff, substantially flat diaphragm 404 with the diameter of the flat area being larger than the outer diameter of magnet 406. The outer most edge of diaphragm 404 is shown having a "V" shaped outer edge that extends downward and away at approximately 60°, however that specific angle is not critical to the design.

Diaphragm 404 is ideally made of a material such as honeycomb, thin aluminum, or other composite and non-composite light-weight materials; conventional cone materials will not work in this application since the diaphragm is substantially flat and light-weight. Diaphragm 404 is suspended with two matched surrounds: an upwardly extending flexible surround 418 having an inner edge attached to the top of the outwardly extending leg of the "V" shaped edge of the diaphragm and an outer edge attached to the top, outer most flange of basket 402; and a downwardly extending flexible surround 420 having an inner edge attached to the bottom of the inner leg of the "V" shaped edge of the diaphragm and an outer edge attached to a point within basket 402 below the top, outer most flange. With surrounds 418 and 420 mounted in this way, maximum linearity of the inward/outward strokes of the speaker is achieved. Between the attachment points of surrounds 418 and 420, ventilation holes 426 have been formed around the circumference of basket 420. Attached to the lower center of diaphragm 404 is voice coil 412 that fits loosely around the upwardly extending portion of steel doughnut 410 with the upper most turn of the coil of voice coil 412 being spaced  $0.5\alpha$  below the inner surface of the diaphragm and the coil winding having a height of  $2\alpha$  in this overhung configuration. By making the height of the coil winding the same as the thickness of the magnet makes it possible to minimize the overall height of the speaker in every excited and unexcited positions of the diaphragm. With respect to each of the views of Figures 36A, 36B and 36C, and each of the embodiments discussed below, the thickness of the diaphragm ~~will have~~ adds the same amount to the overall height of the speaker in each illustrated state, and since the thickness of the diaphragm can vary depending on the material used, for comparison purposes, the thickness of the diaphragm is not included in the height calculations.

Page 36, lines 8-16:

Figure 36A illustrates the position of the various components of this speaker embodiment when no current is flowing through voice coil 412 and when the speaker is not being driven. In this position, surrounds 418, 420 are relaxed with the lower half of

the coil winding **[[is]]** opposite the upper half of the magnet and the inner surface of diaphragm 404 spaced apart from the upper surface of ring 408 by a distance of  $\alpha$ . Thus the overall height of the speaker is the spacing between diaphragm 404 and ring 408,  $\alpha$ , plus the thickness of ring 408,  $T$ , plus the height of magnet 406,  $2\alpha$ , plus the thickness of the flange of 410,  $T$ , plus the thickness of the bottom of basket 402,  $H$ , for a total of  $3\alpha + 2T + H$ .

Page 40, line 25 through page 41 line 9

Figure 37A illustrates the position of the various components of this speaker embodiment when no current is flowing through voice coil 412 and when the speaker is not being driven. In this position, surrounds 418, 420 are relaxed with the upper half of the voice coil winding **[[is]]** opposite the lower half of the magnet, and the inner surface of plate 413 of diaphragm 404' is spaced apart from the upper surface of the flange of 410' by a distance  $\alpha'$ . Thus the overall height of the speaker is the distance between diaphragm 404' and the upper surface of 410',  $\alpha'$ , plus the thickness of 410',  $T$ , plus the height of magnet 406,  $2\alpha'$ , plus the thickness of ring 408,  $T$ , plus the spacing between ring 408 and the inner surface of 411,  $\alpha'$ , plus the thickness of 411,  $J$ , plus the distance between 411 and the bottom of the basket,  $\alpha'$ , plus the thickness of the bottom of basket 402',  $H$ , for a total of  $5\alpha' + 2T + J + H$ .

Page 50, lines 8-23

Referring next to Figure 47 there is shown, in cross-section, or a center slice of, a convention speaker with the spider connected to the top edge of the voice coil bobbin and without cross-hatching to minimize confusion. This speaker includes a basket 600 with the excitation motor mounted in the bottom of basket 600. The motor includes a steel center pole piece 610 centered in the bottom of basket 600 and extending upward away from the bottom of the basket into the interior thereof. Next there is shown a pair of circular magnets 608 resting on an outward extending flange of pole piece 610

and surrounding the upward extending portion of pole piece 610. Then, on the top surface of the top magnet 608 is a circular steel top plate 606 having a circular center hole that has a diameter that is somewhat larger ~~that~~ than the outer diameter of pole piece 610 to allow room for the lower portion of voice coil bobbin 602 and the voice coil 604 wound thereon to pass within a narrow space between the outer surface of pole piece 610 and the inner hole through top plate 606. Thus the inner diameter of bobbin 604 is slightly larger than the outer diameter of pole piece 610 and the outer diameter of the combination of bobbin 602 and voice coil 604 wound thereon is smaller than the diameter of the center hole in top plate 606.

Page 53, line 21 through page 54, line 4

To complete the assembly of the speaker, lateral support diaphragm 622 is then put in place. As can be seen in Figs. 48A and 48B, on the under side of diaphragm 622 two centering features are formed thereon. One is a centering ring 624 that is perpendicular to the under side of lateral support diaphragm 622 with the center of the circle formed by centering ring 624 being the center of lateral support diaphragm 622, and the inside diameter of centering ring 624 is substantially the same as the outer diameter of extension ring 628. Slightly spaced apart from, and inside centering ring 624 is a circular positioning bead 636. Circular positioning bead 636 could be formed as a **continues continuous** ring of material or spaced apart raised dots in a circle inside centering ring 624.

Page 54, line 23 through page 55, line 3

Lateral support diaphragm 622 functions similarly to the "cone" of a conventional speaker; diaphragm 622 is the sound radiator in the speaker of the present invention **and wherein** the cone is the sound radiator of the conventional speaker. In the present invention the lateral support diaphragm 622 is stiff, substantially flat and lightweight. Additionally, cone 616 can be made of conventional materials since the only purpose of cone 616 is one of the structural elements that minimize or eliminate wobble

of bobbin 602.

Page 55, lines 5-11

The ends of the wire of voice coil 604 are typically glued to, and dressed up the **out-side outside** of bobbin 602 toward the upper end portion thereof. Those wires could be then dressed up the underside of cone 616 for attachment to other wires that are attached to input terminals (not shown). Alternatively, the ends of the voice coil wires that have been dressed up the outside of bobbin 602 could be connected to wires that have been placed through spider 612 with the other end of those wires close to basket 600 then attached to input terminals (not shown) mounted on the basket.

Page 58, line 21 through page 59, line 9

In each of Figs. 49A and 49B ~~[[is]]~~ **it** can be seen that when cone 616 is not in the at rest position of Fig. 47 there is a harmonic bending wave that travels through the skin of cone 616. As can be seen in Figs. 49A and 49B, the forces on cone 616 have a bending waveform illustrated by the variation in magnitude of the force vectors along the surface of cone 616 with the direction of the force vectors changing direction at some point on the surface of cone 616. At the point where the force vectors change direction, cone 616 is bent in different directions that can be likened to bending of a thick piece of wire. These force variations during operation of the speaker cause plastic deformation of cone 616 with the material of cone 616 having a cycles per life failure rate. The non linear stiffness in the cone, along with the offset in the spider and in the outer surround will produces a wobble that is harmonically related to the signal. This distortion is audible and is typically ignored in current speaker design. If these differences in these parts are large enough and do not cancel each other, their force will cause voice coil bobbin 602, and perhaps also voice coil 604 to rub ~~some-where~~ **somewhere** within the magnet assembly and eventually lead to speaker failure.

Page 65, lines 16-22

The low profile speaker of Fig. 53a is the same as that shown in Fig. 51 with one modification. In Fig. 53a, cone 674' includes radially positioned topside ribs 696 and radially positioned bottom side ribs 698 which have been included to give cone 674' more resistance to flexing **that than** cone 674 of Fig. 51. By reducing the flexibility of the cone and the use **of** lateral support diaphragm 676, the wobble of voice coil bobbin **670** is further reduced. Also shown in Fig. 53a, are cooling holes 697 through the bottom plate of magnet assembly 664.

Page 67, lines 6-25

An inner cone 726 has a substantially "pie pan" shape with a outwardly flaring side forming an outer edge and a flat bottom through which is formed a central circular opening with the edge around the central opening (e.g., the inner edge) curved slightly inward. Inner cone 726 is mounted face down with the mouth or largest diameter outer edge extending downward into basket 700. The inner edge of inner cone 726 has a diameter that is substantially the same as the outer diameter of bobbin 702 and fitted around bobbin 702. When in place the inner edge of inner cone 726 is below the top edge of bobbin 702 forming a small circular glue well 730 around and in contact with bobbin 702 to hold glue for adhering the inner edge of inner cone 726 to bobbin 702 below the top edge of bobbin 702. When in place, the plane of the flat bottom edge of inner cone 726 is substantially parallel to, and below the top edge of bobbin 702. The outer edge of inner cone 726 forms an opening that is larger than the outer dimensions of magnet assembly 704 so the outer edge of cone 726 does not come into contact with magnet assembly 704 on the in-stroke of the speaker when in operation, and smaller **that than** the inner dimensions of basket 700 for the same reason. Additionally, the outer edge of inner cone 726 is attached to the inner edge of inner surround 708. The outer edge of inner surround 708 is attached to basket inner edge 712 with the shaped portion (shown here as a 1/2 circle) of inner surround 708 extending toward the bottom of basket 700 below basket inner edge 712 and the outer edge of inner cone 726.

Page 68, lines 1-15

Outer cone 724 has a typical cone shape that extends downward into basket 700. Outer cone 724, unlike typical cones, has a large center hole formed by the inner edge. The dimensions of the outer edge of outer cone 724 are smaller ~~that~~ than the dimensions of top rim 710 of the mouth of basket 700 and larger than the outer dimensions of the outer edge of inner cone 726 while the dimensions of the inner edge of outer cone 724 is smaller than the outer dimensions of the outer edge of inner cone 726. When in place, the outer edge of outer cone 724 is attached to the inner edge of outer surround 706 with the outer edge of outer surround 706 attached to top rim 710 of the basket with the shaped portion (shown here as a 1/2 circle) of outer surround 706 extending outward from the mouth basket 700 between top rim 710 and the outer edge of outer cone 724. The inner edge of outer cone 724 has the same shape as the side of inner cone 726 and contacts the side of inner cone 726 near the outer edge of inner cone 726 at contact point 732. Contact point 732, given the shapes of the two cones, has a "V" shape into which glue is added to attach the two cones, one to the other, at that point.

Page 68, line 23 through page 69, line 11

Also shown in Fig. 55a is the air cooling path through the speaker as illustrated with arrows. Air is shown entering the bottom of basket 700 through air vents 720 in bottom pole piece 714 and center air passage 718 through bottom pole piece extension 716. Air through center air passage 718 extends upward into the center of bobbin 702, while air entering air vents 720 can take two different paths: one into the center of bobbin 702 between bobbin 702 and the outside of bottom pole piece extension 716; or, two into the bottom of basket 700 between the outside of bobbin 702 and the upper plate of magnet assembly 704. Since lateral support diaphragm 734 is a solid piece air ~~hole~~ holes 722 have been provided in the side of bobbin 702 below well 730 so air can pass into the space between the bottom of lateral support diaphragm 734 and inner cone 726 and then through air passage holes 728 in inner cone 726 into the bottom of

basket 700. Basket 700 has vent holes (not shown to minimize confusion when viewing Fig. 55a) therethrough to permit the air to mix with air outside the basket and to return to the cooling path illustrated. The cooling path illustrated here is that when the voice coil bobbin 702 is on the out-stroke and is just the reverse on the in-stroke.

Page 69, lines 18-21

The materials used to make the various components of the speaker are a matter of design choice and can ~~been be~~ those typically ~~use~~ used. Given the more complex construction of the present invention, the two cones could be made of a lighter weight foam or composite core material.

Page 70, lines 12-21

The low profile speaker of Fig. 57a is the same as that shown in Fig. 56a with two modifications. In Fig. 57a, the bottom side of lateral support diaphragm 734" includes a outward extending alignment ring 738 having a selected cross-section (shown here as semi-circular, however it could be "V" shaped, square, or any other desired shape). Additionally, inner cone 726' includes alignment ring shaped groove 740 formed in the upward facing side of the "bottom" of inner cone 726' with groove 740 being positioned, sized and shaped to receive alignment ring 738 of the lateral support diaphragm 734". The use of ring 738 and groove 740, the final positioning of lateral support diaphragm 734" is more positively assured and provides an added measure of stiffness to the assembly of cones 724 and 726', and diaphragm 734".

Page 71, lines 1-11

Fig. 58a is a cross-sectional view of another low profile, shallow speaker of the present invention. Several of the components of this speaker are common to previously discussed low profile speakers of the present invention and oriented here as in those speakers, namely basket 700, voice coil bobbin 702, magnet assembly 704, outer surround 706, and inner surround 708. The outer edge of outer surround 706 is



attached to top rim 710 of basket 700, and the outer edge of inner surround 708 is attached to inner edge 712 of basket 700. Additionally there is a sleeve 748 firmly attached around voice coil bobbin 702 above the voice coil with the top edge of sleeve 748 formed in an outward flaring lip 749 that is below the top edge of bobbin 702 that extends a measurable distance above lip 749. This embodiment also includes an inner cone 742, an outer cone 744 and lateral support diaphragm 746.

Page 71, line 13 through page 72, line 2

When assembled, the inner edge of inner surround 708 is attached to the under side of the outer edge of inner cone 742, and the inner edge of outer surround 706 is attached to the top side of the outer edge of outer cone 744. At each of the points of contact between inner and outer cones 742 and 744, the two cones are glued together with each of the small "V" shaped areas in inner cone 742 designed to be wells for glue. Additionally lip 749 of sleeve 748 forms a glue well around bobbin 702 with the inner edge of outer cone 744 glued into that well. The last piece of the assembly is lateral support diaphragm 746 having a center cap like formation that fits around, and is glued to, the top edge of bobbin 702. Additionally, the long straight portions of diaphragm 746 that extend outward from the "cap" are the same length as opposing **[[flange]]** straight portions of outer cone 744 with those straight portions of the outer cone and diaphragm glued one to the other. When fully assembled, inner and outer cones form several sealed internal spaces that, together with the various bends of the cones adding rigidity to the cone assembly with the diaphragm adding to that rigidity. The rigidity minimizes flexing of the cones while also minimizing wobble of the voice coil bobbin during operation of the speaker.

Page 73, line 15 through page 74, line 1

From the various views it can be seen that the inner edge of inner cone 752 is turned upward to form a substantially vertical side wall forming a circular opening that has a diameter that is substantially the same as the outer diameter of bobbin 702. In

the assembled position, the circular opening is fit around, and glued to **[[is]]**, bobbin 702 at a position similar to the location of lip 749 in Fig. 58a below the top edge of bobbin 702. From Figs. 60b and 60c it can be seen that inner cone 752 is shaped to include three glue wells in the substantially horizontal portion thereof at points A, B and C, that are disposed to receive points D, E and F of outer cone 754. Outer cone 754 at point E on the top side defines a "V" shaped channel that is disposed to receive the outer edge G of lateral support diaphragm 756. Additionally, inner cone 752 is shown with optional ribs 752 that extend half way up the outer most "V" shaped region. The positioning of optional ribs 758 can be seen more clearly in the top view of inner cone 752 of Fig. 60d.

Page 78, line 19 through page 79, line 8

In the right portion of Fig. 64a there is a partial cross-sectional view that illustrates a cone 862 - sleeve 858 - bobbin 850 interconnection technique. Sleeve 858 is shown placed around bobbin 850 and glued in place with the lower end of sleeve 858 in contact with the top most coil of voice coil 852 with the top edge square bottom trough 860 opening toward, and lower than, air holes 856. Cone 862 has cone inner edge 864 that has a diameter that is substantially to same as the outer diameter of bobbin 850 with edge 864 fit within, seated and glued in place in trough 860 of sleeve 858. Also shown lateral support diaphragm 868 with a portion of the underside thereof glued to a portion of the top surface of cone 862. Additionally, the inner surface of center circular shoulder 870 of lateral support diaphragm 868 **is** glued to top edge outer edge 854 of bobbin 850 with the inner diameter of circular shoulder 870 being substantially the same as the outer diameter of bobbin 850. Further, to permit coiling of voice coil 852 a series of spaced apart holes 866 are defined by cone 862 around bobbin 850 in the triangle formed by cone 862, diaphragm 868 and bobbin 850 to allow air to flow through air holes 856 in bobbin 850 into the triangular **[[are]] area** described above and out through air holes 866 into the vented basket (not shown) of the speaker.